Recommended Adjustments in Livestock-Forage Research in the Southern Region

Report of
the Livestock-Forage
Review Committee,
Southern Region, U.S.A.

July 1978

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FOREWORD

The Southern Region of the United States is blessed with extensive wealth in climate and natural resources. How to best use, yet protect these resources, is a challenge for agriculturalists of today and the future. A knowledge base is needed if they are to meet the challenge. Agricultural research, therefore, must play a key role as more intensive agriculture spreads across the South.

Eleven major and a myriad of minor studies in recent years have suggested approaches and set priorities for segments of the livestock-forage industry responsible for increasing red-meat production in the South. These studies were most useful in high-lighting research needs, but collectively they resulted in recommendations too comprehensive and too costly to withstand the pressures of an ever-tightening research budget.

Agricultural research administrators needed to know how to increase the efficiency of conducting research through coordination, and how to select the "highest-of-the-high" priorities for funding.

A Select, Ad Hoc Committee was appointed by Dr. A. W. Cooper and Dr. Doyle Chambers at the request of the Southern Experiment Station Directors to help with these decisions. The Report in the pages which follow represents the collective thinking of the scientists charged with the following objectives:

1. Review the research needs for livestock and forage

2. Assess ongoing programs

3. Make recommendations to scientists and administrators for adjustments

4. Make recommendations for filling gaps not being worked on

At the first meeting of the committee, a number of subcommittees were appointed to develop statements concerning technological and research gaps, and suggest additional research. From the input, the co-chairmen developed a draft. The draft was revised at two meetings of the entire team and two additional meetings of the co-chairmen. The team developed outlines of seven of the most critical areas of research to be funded (fundable packages). The suggested locations for conducting the research outlined in the fundable packages are not exclusive. The locations were selected to represent the different physiographic areas in the Southern Region.

SUMMARY

The Southern Region varies in elevation, soil, climate and adapted forage species. In some areas of the Region forage growth occurs throughout the year, whereas, in the northern areas of the Region forage production during the winter is limited or non-existent. Beef production in the Region has consisted mainly of feeder cattle production. Forage production is much more important than grain production, which accounts for the lack of development of a large beef-fattening industry, except for West Texas and Oklahoma. Forage yields from adapted varieties of warm season grasses have been very good, but available energy content of these grasses is limited. Use of more legumes, development of higher-energy warm season grasses and adequate control of diseases, pests, weeds and poisonous plants would be helpful in developing more cattle finishing. Infestation with external and internal parasites and diseases, which is more serious in the Southern than other regions, undoubtedly contributes to the suboptimal level and efficiency of beef production.

Forage fattening of cattle has consisted mainly of feeding limited grain on summer pasture, or, where possible, grazing cereal forages in the winter with or without grain. There has been no "systems" type of approach integrating forage production, breeding of cattle, pest management, processing of carcasses and economic analysis.

Cattle have been finished to "good-to-choice" grade on good quality pasture supplemented with grain or on high corn-silage rations. Cattle finished on these regimens produce desirable carcasses with no off-color or undesirable taste. Carcasses from grazing cattle not fed grain usually lack marbling, the lean meat is darker, the bloom fades more rapidly in retail display, external fat is often yellow in color and the meat may lack tenderness and possess off-flavor.

A number of technological gaps and research needs were identified, based on present and past research in the Southern Region. Research problems were identified and suggestions were made concerning approaches to be used to solve these. From these, seven fundable packages were developed to expand the research effort in the area of Livestock-Forage, as follows:

1. Calf Production and Marketing Alternatives
2. Improving the Quality and Consumer Acceptance of Products from Forage-Fed Beef
3. Genetic-Environment Interactions in Beef Cattle Production
4. Improving and Maintaining Forage Quality to Optimize Livestock Feeding.
5. Development and Testing of a Simulation Model to Highlight Critical Livestock-Forage Management Research Needs
6. Development of Innovative Methods to Enhance Livestock-Forage Management Research
7. Assess the Role of Livestock-Forage Production as a Multiple Land Use Alternative on the Marginal and Disturbed Lands of the South

Although the fundable packages are divided into seven categories, a systems approach is visualized. For example there will be coordination among development of high energy forages, alternatives in finishing cattle, evaluation of the quality of the meat and economic analysis of the entire system.

It is recognized that a serious void has been insufficient coordination in the Livestock-Forage research area. It is recommended that a coordinator be selected and a committee be appointed by State and SEA directors to work with the coordinator in implementing the coordinated development of a strong livestock-forage research program in the Southern Region.

Objectives

The main objective of the Review Team was to determine what research effort would be needed in the Southern Region to improve the efficiency of beef production on high forage regimens. It appeared that the area which needed the most attention was the finishing of cattle with maximum use of forage. However, the thrust was not to consist only of producing fat cattle, but was to include all facets of beef production.

Although considerable research effort has been devoted to production of beef from forage, productivity has been limited due to insufficient coordination of effort. One of the objectives was to develop a plan for improved coordination of the effort among state and federal agencies.

The main effort of the Committee was directed toward beef production. Enterprises such as dairy and sheep production received minimum attention. It is recognized that in many practical situations they would dovetail with efficient beef production.

Ultimately, the objectives of the Committee were to identify productive areas of research for improved efficiency in Livestock-Forage Production, to develop fundable packages to accomplish the work and to develop mechanisms for more effective coordination of the research.

The Southern Beef-Forage Industry

The Southern Region encompasses a wide range of soil, climate and adapted forage species. The South's eight physiographic areas, with distribution for forage types based on mean annual air temperature and precipitation, are included in Figure 1. Rainfall varies from less than 25 in. in western Texas and Oklahoma to more than 50 in. in the humid Gulf Coast States. Elevation ranges from sea level to over 4,000 ft. Summer climate is warm and humid in the Gulf States, hot and dry in the High Plains, and cool in the mountainous areas. Winter brings only a few nights below freezing in the extreme southern areas, but considerable snow accumulation and low temperatures in the more northern zones.

The types of forages grown in the Southern Region are determined more by temperature and rainfall than by soil. In the northern areas, cool-season perennials predominate and there is some use of warm season annuals. However, forage production during the winter is limited or nonexistent. In recent years, interest has increased in stockpiling forages **in situ.** However, producers still depend mainly on preserved forage (hay or silage) for winter feed.

In the southern areas, warm-season perennials predominate, but warm-season annuals are also grown. Usually, cool-season annual grasses and legumes can be grown, but these are used only to a limited extent in beef production systems. In the middle areas of the Region, warm- and cool-season perennials and warm-season annuals are grown during the summer. Cool-season annuals grow well during the winter, except during periods of extremely cold weather. Producers in Texas and Oklahoma have made very good use of cool-season annuals, such as wheat pasture, for grazing stocker cattle during the winter, then moving them into the feedlot.

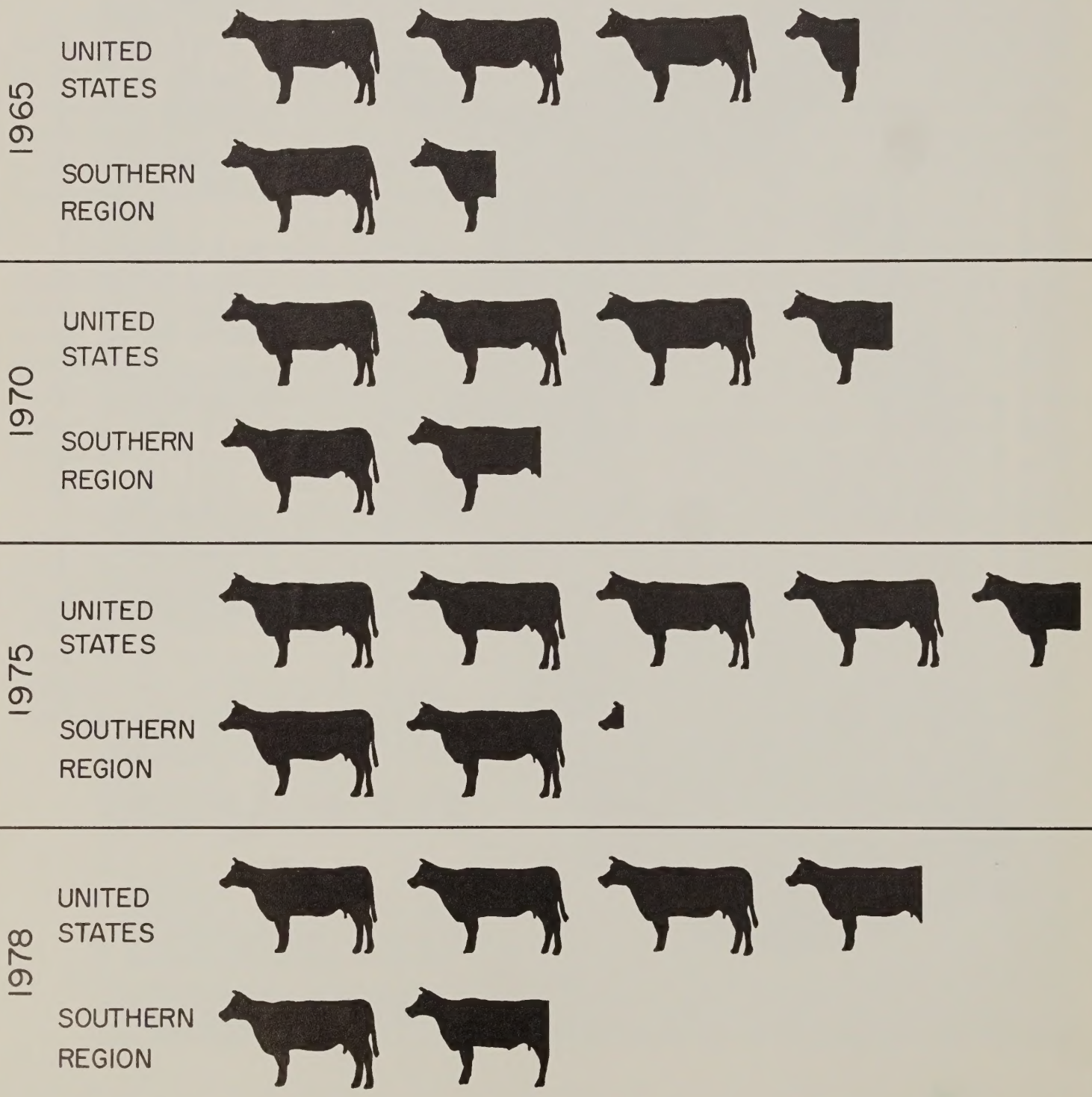
Adequate supplies of high-quality forage during the entire year are desirable for economical beef production. Most of the beef industry in the Southern Region, with the exception of the large feedlots in Oklahoma and Texas, has consisted of feeder cattle production and, in many instances, only feeder calf production. Too frequently, very light calves have been produced for marketing. At times, the price per pound has been very high for feeder calves, but usually the return per cow unit is marginal, at best. The South supports 50% of the beef cows in the U.S. (Figure 2.) mostly on small farms where acceptance of new technology is generally slow.

Excellent research has been conducted in selection and development of forage varieties well adapted to the climate of the Southern Region. Generally, with optimum fertilization, moisture and management, dry matter yields per acre have been good. One problem has been the low available energy content of warm-season grasses. This problem may explain the generally unilateral development of cow-calf systems, which do not require a concentrated energy source. The use of more legumes in pasture mixtures would help because, generally, they are better energy sources and higher in protein than are grasses. Development of high-energy, warm-season grasses should be a fruitful area of research.

In the northern areas, availability of forage during the winter is a problem. Use of cool-season annuals in areas where these will grow satisfactorily, stockpiling cool-season perennials, and greater use of high-quality cereal crop forage would be helpful. More information is needed on the value of silages other than corn for high production and maintenance of satisfactory forage and beef yields per acre. More information is also needed on the loss of nutrients from stockpiled forages. Fescue, for example, is very high in soluble carbohydrates in the fall (October and November), but apparently considerable amounts of nutrients are lost during "winter burn." The extent of this burn in fescue and other cool-season grasses, and methods of preventing it, need to be determined.

Figure 1.—Land resource regions and major land resource areas of the United States.

FIGURE 2. BEEF COW NUMBERS IN THE U.S. AND THE SOUTHERN REGION OF THE U.S.



The technology is available that would enable beef producers in the Southern Region to adopt a variety of production systems. However, systems research has not been conducted to determine the impact the introduction of this technology would have upon the income-producing capability of forage and livestock enterprises in view of the constraints imposed by available resources and management (i.e., should producers divert resources and management from other, more lucrative enterprises in order to adopt technology that promises to increase the income from livestock and forage?).

Perhaps southern producers should use "double cropping" to produce two high energy crops such as corn for silage and small grain for pasture rather than one relatively low-quality pasture such as Bermudagrass. The possibilities for designing systems including high-quality as well as low-quality forages are virtually endless.

Problems of low calf-crop percentages, light calves at weaning, disease and infestation by external and internal parasites are more serious in the Southern than in any other region. The suboptimal calf production at weaning may be due, in part, to the disease and parasite problems. Undoubtedly, the poor management of forage and cattle and the failure to match cattle production systems to forage production systems are also contributing factors. Animal health problems must be minimized before efficiency of cattle production can be maximized.

Current methods of controlling external and internal parasites are primarily based on use of pesticides and anthelmintics. Effectiveness of these methods is quite variable and generally short lived. Effective control of parasites should be based on treatment and prevention, combined with improved pest, animal and pasture management. Control measures for diseases such as shipping fever, calf scours, pinkeye, and anaplasmosis, however, are not readily available, and reserach should be intensified on these problems. Changes in management systems would help prevent or control some of these health problems. For example, if calves were kept until they weighed 700 to 750 lb., probably the shipping fever problem would not be so serious. Also, calving under pasture rather than barnyard conditions should help to control calf scours.

The art of preserving forages as hay or silage is not new, but current methods are still not perfect. Losses are variable, but substantial, during harvesting and storing forages as hay or silage. New concepts in these areas include use of large hay packages, above-ground ensiling in bunker and "sausage" silos, use of additives to improve quality of preserved forage and optimizing grass silage maturity, dry matter intake and digestibility.

Beef breeding and selection efforts in the Southern Region have consisted of 1) upgrading the native cattle by using bulls from British breeds, 2) selecting for performance traits and beef type, and 3) introducing Zebu blood to increase resistance to heat, humidity and parasites. Recently, efforts

have been directed toward use of large or "exotic" cattle, but related research efforts have been quite restrictive in that often only one management system has been used and this system has sometimes not been "in tune" with normal practices in the area.

Production efficiency and carcass quality have not been evaluated in many breeding and selection studies. Future studies should involve systems research to study the interaction between genotype and environment as it affects efficiency of production and carcass quality. This research would answer the question, "Will the same kind-of-cattle produce optimally in the northern and southern areas of the Region?". It would also provide valid relationships to describe how livestock interact physiologically with their environment.

Reproductive rate is suboptimal in the Southern Region. In fact many studies have identified this as one of the main deterrants to optimum efficiency in beef production. Certainly, attention must be given to this problem, especially with the increased use of exotic breeding.

Meat from cattle not fed grain usually lacks marbling, the lean is dark, the bloom (attractive red color) fades rapidly in retail display and external fat is often yellow. The meat may also be tough and off-flavor. U.S.D.A. grading standards now penalize this type of beef to a greater extent than ever before, notwithstanding the fact that Americans consume 40 to 50% of their beef in the form of hamburgers, stews, etc., in which a high amount of fat is not essential and may even be undesirable. In the past, meat from cull cows has been used for this market. With the trend toward increasing use of these types of foods, the demand for lean beef will increase. The recent reduction in numbers of beef cows and the continuing reduction in numbers of dairy cows means that some younger cattle will be used for the lean-beef market. Livestock producers in the southeastern area of the Southern Region should be able to compete very favorably for this market.

Cattle can be finished to "good-to-choice" grades on good-quality pasture either with or without supplemental grain, or on high corn-silage rations. Cattle finished on these regimens produce desirable carcasses with no off-color or undesirable taste. The amount of supplemental grain needed is usually minimal; it amounts to 1% of bodyweight for cattle on pasture and 0 to 1% for cattle fed high corn-silage rations. These finishing practices should be incorporated into systems in the Southern Region and compared with finishing on high grain levels in the western feedlot areas (Figure 3).

Systems analysis and modeling have been useful to industry and research. Unfortunately, these techniques have been little used in livestock and forage management, but they could be valuable tools to pinpoint critical areas of research needed to enhance and increase the efficiency and the development of the beef cattle industry in the Southern Region.

Technology Gaps and Research Needs

Careful consideration of the current situation and research effort directed toward the relationships of forage utilization in beef production in the Southern Region reveals the following technology gaps and research needs:

Figure 3. Throughout much of the Southern Region "High-Good" to "Choice" beef can be produced on forages alone.

1) Adapted warm-season grasses with high-energy value.

2) Persistence in perennial legumes and reliable reseeding of winter annuals.

3) Optimum management of grass-legume forages, including fertilizer interactions and antagonisms.

4) Plant characteristics affecting digestibility and intake.

5) Stockpiling high-quality, cool-season forages.

6) Processing and storing forages and crop residues.

7) Methodology in livestock-forage research.

8) Maximizing rate of reproduction in beef cows.

9) Magnitude of animal health problems and development of effective and efficient control methods.

10) Interactions of beef cattle genotype with feeding regimes or environment.

11) Methods of improving the quality and salability of products from forage-fed beef.

12) Modeling research to pinpoint gaps in information.

13) Optimizing land-use for maximizing efficiency.

14) Testing complete production systems.

15) Monitoring quality of beef produced from forage of different qualities supplemented with different levels of grain.

16) Economic feasibility of beef production and marketing alternatives.

Researchable Problems

The committee considers the following to be high-priority researchable problems:

1) Improve forage quality through breeding and selection; protection of forages against insects and diseases; introduction of legumes; effective control of weeds and poisonous plants; more efficient cultural management; and, when needed, better harvesting, storing and processing techniques.

2) Develop methods to rapidly and precisely predict the nutritional value of forages, especially warm-season perennials. Emphasize methods to assess the impact of quality improvement on digestibility and intake in grazing animals and measure voluntary intake by grazing animals.

3) Define and expand the role of low-quality roughages, agricultural and municipal wastes, and by-products in meat production.

4) Evaluate and neutralize animal disease, toxicological, parasitic and stress problems that reduce the efficiency of beef production from forages. Include use of management practices, pesticides, drugs, and pest management technologies to prevent or reduce animal health problems to economical levels.

5) Define major interactions between animal genotype and production situations and discover the underlying causes for the interactions. Reproductive rate and efficiency of performance of offspring should be measured.

6) Maximize the value and salability of products from widely variable forage-fed beef.

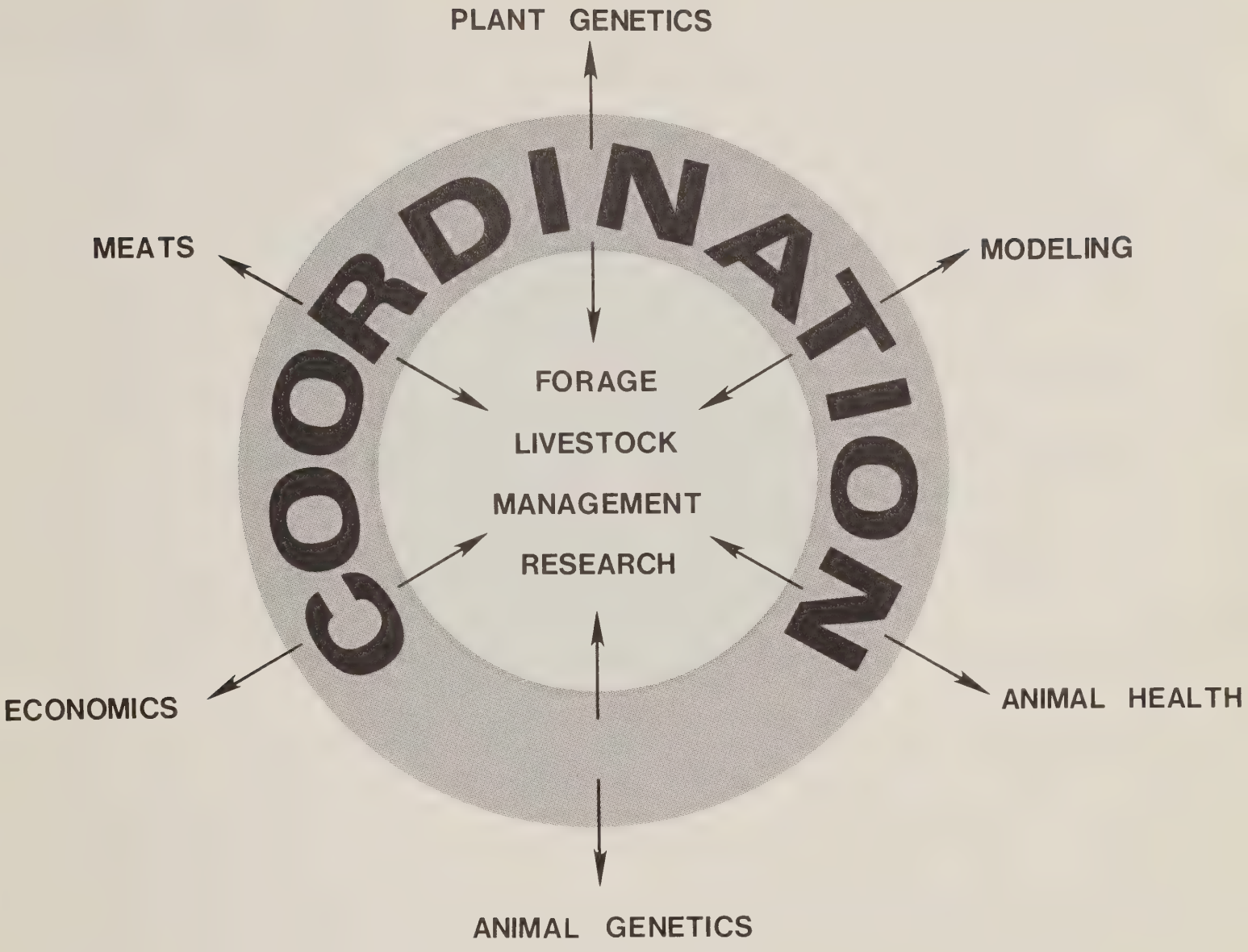
7) Develop potentially profitable and efficient systems of limited grain or high-forage finishing of cattle in confinement and/or on pasture.

8) Define alternative and multiple land uses and predict results accruing from major land- and animal-use decisions. This prediction should emphasize returns on a per acre basis, as well as quality of product.

9) Develop comprehensive models of forage-beef production.

Recommended Approaches

There is unanimity of thought on two aspects of approach. First, the livestock-forage management system **per se** should form the core of the research effort, and it should be carefully coordinated so that the interactions between management, environment and animal type can be measured even to the point of marketing the final product. Emphasis should be placed on systems approaches rather than individual and fragmentary problems. The conceptual model of the interactions of other disciplines with the core effort on livestock-forage research is shown in Figure 4. Second, organization of this research must transcend discipline, provincial, organizational and other classical barriers. Conventional grazing trials with all of their "twists" (e.g., supplementation, harvesting, stockpiling) are repetitive and often wasteful. A form of modeling is needed, with emphasis on determining a) what are the information voids b) what impact can the definition of



A Conceptual Model for Improved Coordination of Multidisciplined Forage–Livestock Management Research

Figure 4. Interactions of Forage-Livestock Management Research

unknown parameters have on the forage-livestock management systems, c) what is the likelihood of success from particular units of research, and d) what are the cost-benefit ratios?

Specific approaches to be used are as follows:

1) Most physiographic regions have well-adapted, high-yielding forage varieties, but quality and good seasonal distribution are lacking. It is recommended that:

   a. Plant breeders "on board" should be supported at somewhat higher levels. Screening for nutritional quality, especially evaluation in animal trials, should be emphasized.

   b. In much of the Region, new breeding efforts should be directed toward well-adapted legumes to fill gaps in grazing programs.

   c. Breeders of warm-season perennial grasses should shift emphasis toward developing grasses with higher levels of available energy.

   d. Management, harvest and storage of forages of high quality should be emphasized.

2) Adequate support should be provided for the development of methods to:

   a. Screen forage qualities by infrared reflectance spectroscopy.

   b. Determine voluntary intake in grazing ruminants.

   c. Evaluate the efficiency and environmental needs of nitrogen-fixing microflora.

   d. More precisely estimate quality and composition characteristics in live animals.

   e. Assess feeder grades to more accurately estimate the value of the calf.

3) Conventional animal nutrition research techniques should be used to determine the potential uses of animal wastes, crop residues, and other under-utilized by-products in forage-livestock feeding systems.

4) Economical control of disease and parasites as well as protection of livestock from toxic elements in the environment is essential for the profitable production of beef within forage-livestock management systems. Therefore, research should be supported to:

   a. Determine the effect that disease, parasites and toxic plants and chemicals have on animals in the livestock-forage interaction.

b. Develop practical systems to reduce stress and respiratory disease in feeder calves.

c. Discover more economical methods, including biological controls, to control major endo- and ecto-parasites.

5) Implement a multilocation study of the interactions of different beef genotypes with different environments (especially forage-based nutritional environments). Also, conduct research to study the interaction of different cattle genotypes and different nutritional regimens within selected locations.

6) In the areas of beef quality improvement and assessment, research efforts are needed to:

a. Maximize the value or improve the quality of products from forage-fed beef in terms of tenderness, flavor, moisture retention, color-of-lean and color stability, and color-of-fat.

b. Develop new products such as flaked/formed or restructured fresh meat items for both retail and "Hotel, Restaurant and Institution" trades.

c. Monitor the effects of different production management systems on carcass quality, retailing, and acceptability characteristics.

7) There will always be confinement feeding of cattle. To better use forage and divert grain to fill direct human needs the following are recommended:

a. Support research to develop principles of feeding high-forage feedlot rations.

b. Study integrated cow-calf and post-weaning growth-fattening systems and assess the cost relationships in producing forage-fed beef.

c. Support efforts to increase the quality of processed feedstuffs and ensiled forages fed in confinement, and define the relationship of harvested vs. grazed forages.

8) The future of the beef industry in the South depends upon availability of alternatives for use of resources. Research is needed to:

a. Compare beef management systems and marketing alternatives involving sale of weaner calves from the South as feeder calves, yearling calves (as either feeder or stocker calves), finished beef for slaughter, or culled breeding animals.

b. Develop systems to produce beef while enhancing the aesthetic quality of the environment, protecting the basic soil and water resources, reducing sources of pollution, and providing increased water supplies for use in population centers.

c. Develop compatible systems of multiple land-use for red meat production.

d. Show clearly how imports and/or exports of beef may relate to the feasibility of a forage-fed beef industry in different parts of the Southern Region.

Recommendations

The Committee specifically recommends that the following actions be taken to assure the expeditious advance of progress to increase the utilization of Southern forages in beef production:

Coordination should be implemented to facilitate research efforts in the Southern Region to improve production efficiency from forages. A person should be appointed as coordinator and charged with improving communications among the scientists involved in the livestock-forage management system (regardless of discipline). The Coordinator should not directly control the distribution of funds, but rather should serve as a key resource person to the research administrators responsible for expenditure of research dollars.

An Advisory Committee should be established to advise and assist the Coordinator. The Advisory Committee should represent the agencies and organizations conducting research on problems related to livestock-forage management research, but also should represent the many disciplines contributing knowledge to the development of comprehensive, profitable production systems. Members of the Advisory Committee should be scientists selected by research administrators to assure that the Committee meets the criteria outlined.

An Executive Committee should be elected by the Advisory Committee to work directly with the Coordinator. These scientists would monitor the nature and needs of the coordinating activity, assure the exchange of organizational, geographical and discipline ideas, and be directly involved in the charting and implementation of improved communications between scientists, administrators and others involved in the conduct of research.

Every effort should be made to discover or develop principles of inter- and intra-organizational personnel management to optimize cooperation and communications among research scientists working on aspects of plant and animal sciences related to livestock-forage management research.

Seven research packages should be implemented in Fiscal Year 1981. They are:

1. Calf Production and Marketing Alternatives

2. Improving the Quality and Consumer Acceptance of Products from Forage-Fed Beef

3. Genetic-Environment Interactions in Beef Cattle Production

4. Improving and Maintaining Forage Quality to Optimize Livestock Feeding

5. Development and Testing of a Simulation Model to Highlight Critical Livestock-Forage Management Research Needs

6. Development of Innovative Methods to Enhance Livestock-Forage Management Research

7. Assess the Role of Livestock-Forage Production as a Multiple Land Use Alternative on the Marginal and Disturbed Lands of the South.

These packages, as outlined in the Appendix, are conceived as projects which are likely to 1) benefit from multi-state, multi-agency, multidiscipline interactions, 2) deliver sizable and timely returns to the developing livestock-forage industry of the Southern Region, and 3) provide the basic information needed to direct the livestock-forage research of the next 25 years toward meeting the challenges ahead. Although the fundable packages are identified separately, the research covered by these should be conducted in concert using a systems approach.

The proposals in the Appendix cannot be accomplished within existing personnel and budgetary limitations, so increases in both are needed to make real progress. Support for the research proposed should not come from redirections within the area of livestock-forage research, but rather, as the National and Regional Planning Committee of ARPAC has suggested, it should result from carefully selected increases in high priority research in the areas of forage and beef cattle. The projected adjustments-in-effort in forage and beef cattle are shown in Figure 5 assuming no increase, or a 20% increase in funding.

FIGURE 5. PROJECTED SCIENTIST YEARS (SY) CHANGE IN SOUTHERN REGION, FY 76-81

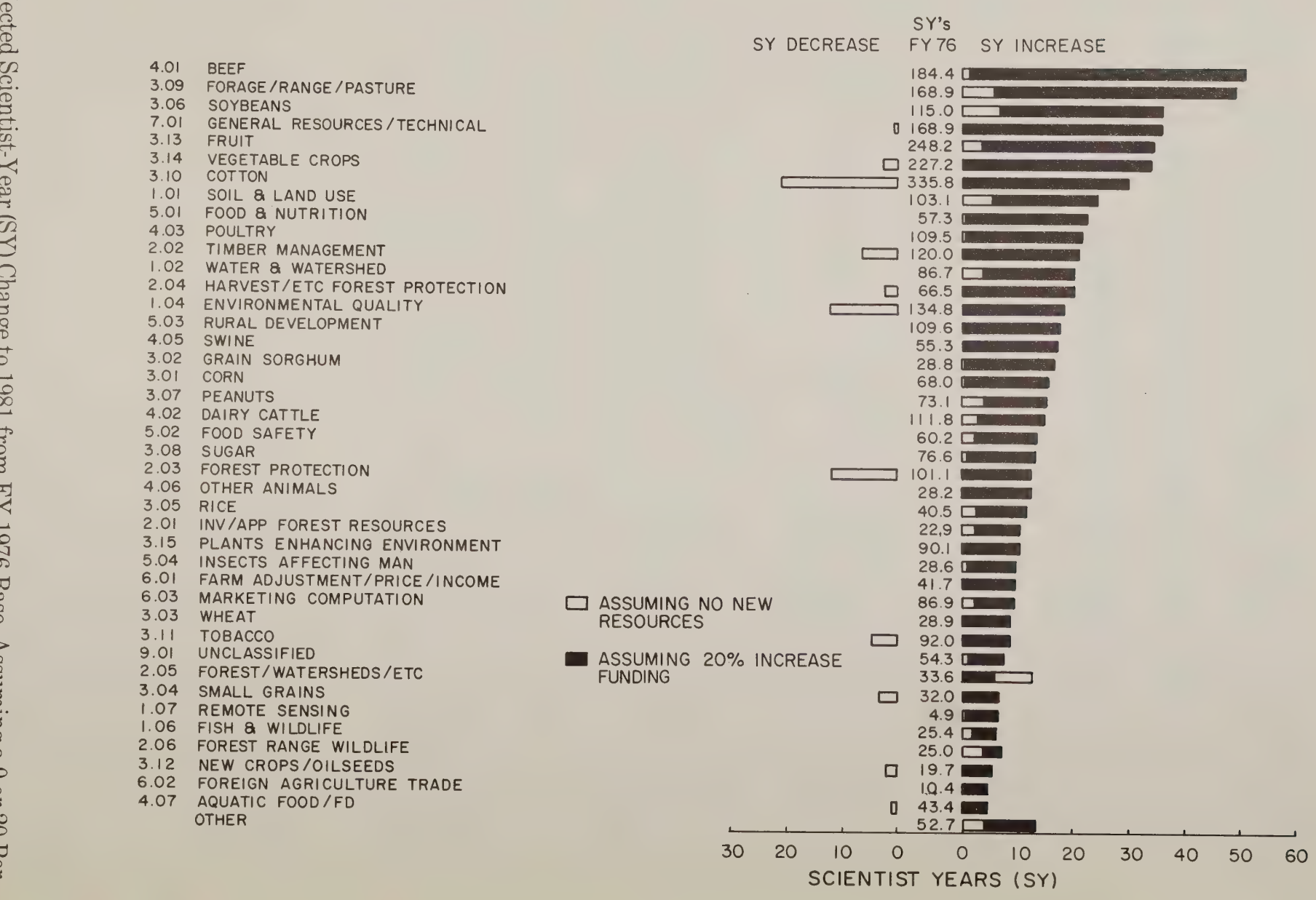


Figure 5. Projected Scientist-Year (SY) Change to 1981 from FY 1976 Base, Assuming a 0 or 20 Percent Increase (National and Regional Planning Committees, ARPAC, Dec., 1977).

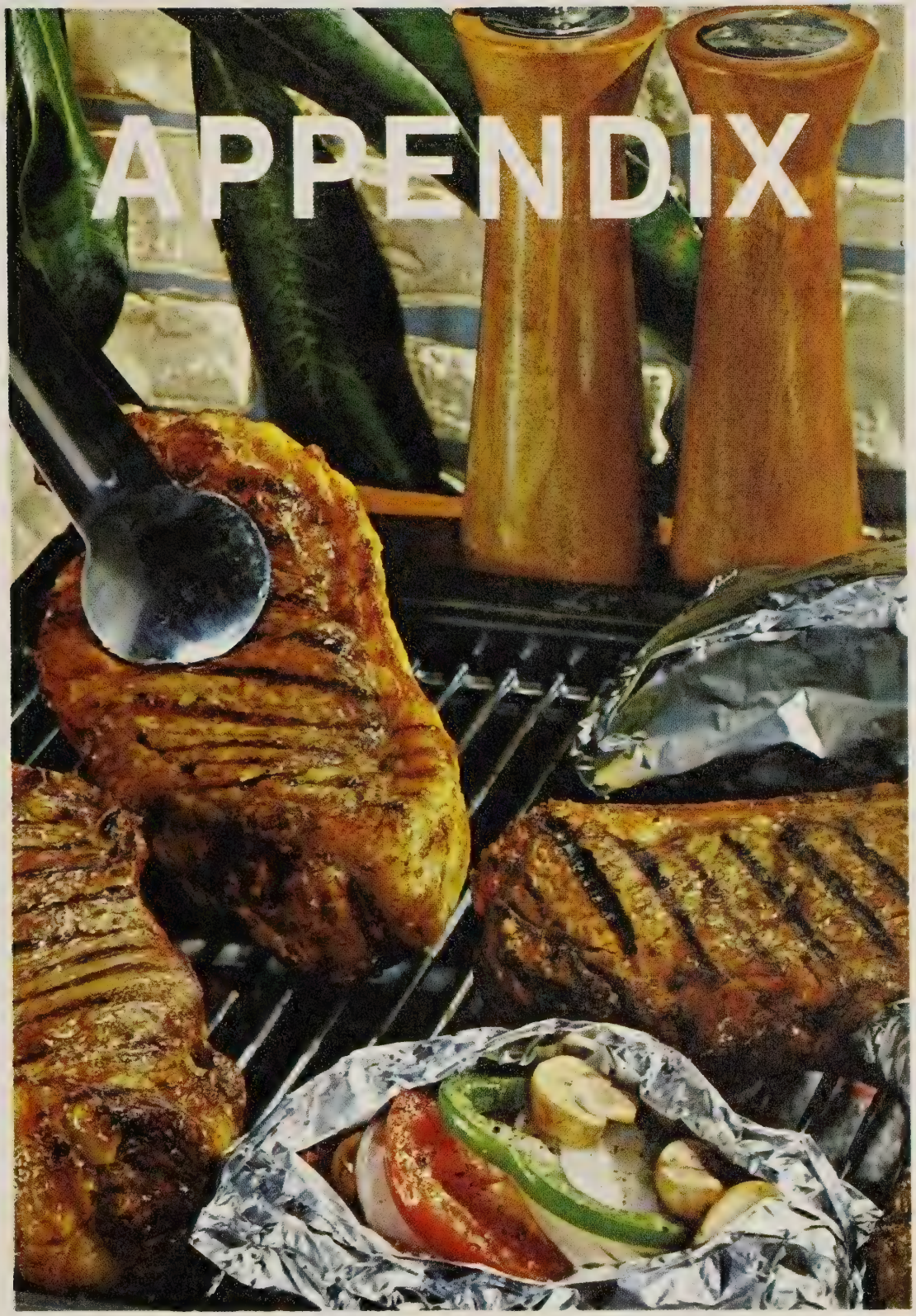


Photo Courtesy of the National Livestock & Meat Board.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Calf Production and Marketing Alternatives

FY 1981 Increase SY **10** Amount **$1,300,000**

Suggested Locations: Rosepine, La.; El Reno, Okla. ; Tifton, Ga.; Raleigh, N.C.; Middleburg, Va., Angleton, Tex.; Fayetteville, Ark.; Mississippi State, Miss.; Auburn, Ala.; Watkinsville, Ga.

Need for Increase: The Southeast beef producers have traditionally shipped feeder calves elsewhere for fattening. It has been generally assumed that it is more economical to produce a feeder calf than to grow and finish the same calf. Theoretically, less feed (nutrients) should be required to put on additional weight equal to the weaning weight of the calf than to produce another calf. Unsatisfactory market conditions often prevail under a situation in which there is no alternative to marketing the calf as a feeder. With improved management to control diseases and parasites, and year-around availability of high quality forage in many areas, alternatives in production and marketing should be reevaluated.

Plan of Work: Research will be conducted to evaluate alternatives in calf production and marketing in order to fully exploit the resources of the Southern Region. At each location a cow herd will be used to produce calves to evaluate the following alternatives: (a) Production and marketing of light (300 lb.) **vs.** heavy (550 lb.) weaned calves; (b) Production and marketing of calves through a backgrounding period (600-800 lb.); (c) Production and marketing of the cattle to acceptable slaughter weight (800-1100 lb.) and grade (good to choice); (d) Retaining possession of cattle after options (a) and (b), and shipping these to be fattened on high grain rations. Due to variation in soil, rainfall, humidity and temperature, research will be distributed in the Gulf Coast, Coastal Plain, Semi-Arid, Peidmont, Plateau and Mountain regions. All inputs including labor and other costs, will be recorded and a detailed economic analysis will be conducted.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Improving the Quality and Consumer Acceptance of Products from Forage-Fed Beef

FY 1981 Increase SY 8 Amount **$1,040,000**

Suggested Locations: Gainesville, Fla.; Athens, Ga.; Baton Rouge, La.; Blacksburg, Va.; Raleigh, N.C.; Auburn, Ala.; College Station, Tex.; Knoxville, Tenn.

Need for Increase: High forage-fed beef is more variable and lower in quality than conventionally-fed beef. It lacks marbling, the lean is darker in color, the bloom or attractive red color fades more rapidly in retail display, weight loss and drip accumulation in the retail package is often excessive, and external fat is often yellow in color. Forage-fed beef lacks tenderness and "forage only" beef often has an off-flavor. Many of these problems must be resolved if consumer acceptability is to be increased. In the past, consumers have purchased high forage-fed beef primarily because it has been cheap, and then only in limited quantities. Unfortunately, such bargain prices have precluded even a nominal profit to producers. Available resources in the Southern Region indicate that a distinct potential exists for increasing the production of high-forage fed beef in this region. However, the fact remains that if forage-fed beef cannot command greater consumer acceptance, the economic feasibility of expanding such an industry in the Southern Region is minimal.

Plan of Work: Research on this problem will be coordinated among a multi-discipline group of scientists both within and among State Experiment Stations and USDA. The problem consists of four distinct subsystems: (a) the influences of breeding, feeding and management systems on the variability and quality of beef produced; (b) the effects of pre-slaughter, feeding, handling and stress conditions; (c) the effects of post-mortem treatments such as delayed chill, electrical stimulation and tenderstretch on the variability and improvement in tenderness, color of lean and other quality characteristics; and (d) the development of flaking, forming and restructuring processes to convert higher percentages of the lower quality carcass into higher valued items for both the retail and institutional trades.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Genetic-Environment Interactions in Beef Cattle Production

FY 1981 SY 5 Amount **$650,000**

Suggested Locations: Knoxville, Tenn.; Brooksville, Fla.; Tifton, Ga.; Stillwater, Okla.; College Station, Tex.; Mississippi State, Miss.; Baton Rouge, La.; Auburn, Ala.

Need for Increase: Production system efficiency is influenced by complex interrelationships among cow size, calf size, maternal ability and market end point, rather than by excellence in a single trait(s). Differences in feed efficiency among a wide range of types and breeds of cattle have been small when reproductive performance was similar, young animal growth was commensurate with mature size and offspring were slaughtered at similar body compositions. However, large differences have been measured where one or more of the above varied. Differences among animals in milking ability, origin and rate of maturing interact with different location and / or pasture regimes only where low energy feeds are involved. Hence, much of the variation in production efficiency appears to result from lack of adaptation to particular production situations involving low quality and/or marginal forage. Causative mechanisms responsible for differential responses of cattle to varying production situations are not known. The range of genotypes and production situations are too wide to allow emperical testing of all combinations. Potential improvement of 10 to 15% in efficiency of the production system seems a reasonable goal.

Plan of Work: Research on this problem will be conducted at locations representing the range of production environments and/or forage regimes used for beef production in the Region. Responses of the range of phenotypes and genotypes of cattle, within and among breeds and breed combinations, to the above range of forages will be measured, including the usual life cycle production variables depicting size, rate of maturing and reproductive performance. Animals will be characterized according to voluntary feed intake, digestibility, grazing selectivity and priority of nutrient utilization in marginal nutritional situations. These characteristics will be related to performance in the different environments. Selection will be for and against characteristics related to performance in the respective environments. Genetic parameters will be estimated for variables found to be related to performance. The ultimate goal of this research will be to develop an understanding of the underlying causes of genotype-environment interaction.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Improving and Maintaining Forage Quality to Optimize Livestock Feeding

Suggested Locations: Alabama, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Oklahoma, Texas, Virginia

FY 1981 Increase SY 8 Amount **$1,040,000**

Need for Increase: Economical production of high-quality forage is essential for the continued growth and success of the livestock industry in the South. Forage quality as measured by beef cattle grazing and feeding trials has been increased up to 33% by breeding new cultivars of Bermudagrass and pearl millet. Weeds and poisonous plants are deterrants to forage production and a high rate of performance in cattle. Forage quality is usually improved by growing legumes with grasses, and the legumes add nitrogen to the mixture. Better legume cultivars must be developed to provide dependable grass-legume mixtures for the sandy soils of the South. Systems of year-around grazing which permit the animal to harvest most of the feed consumed should increase the efficiency and cut the cost of beef production. The proposed research will create grass and legume cultivars with better quality and will permit the development of cultural and management methods that will optimize livestock feeding.

Plan of Work: Grass and legume cultivars with improved quality will be bred and will be used to determine the most productive crop combinations and sequences for greatest economic returns. Seasonal quality of forage will be determined to indicate energy and nutrient deficient periods. Combinations of forages will be sought to meet the nutrient requirements with minimum supplementation. All data will be analyzed to develop the most economical system(s).

The diversity of soil and climate in the South and the large number of species that must be used to supply forage in the South will require that the work be located in the best qualified station within each of the states listed above. Specific objectives for this research will include: (1) breed grass and legume cultivars with improved quality and dependability; (2) develop optimum management procedures for the new grass and legume cultivars when grown alone and in mixtures; (3) identify causes of stand failures and lack of persistence (insects, diseases, nematodes, etc.), and attempt to solve these problems; (4) evaluate new cultivars by laboratory assay and when grazed, fed as hay or silage or when fed as stock piled forage; (5) determine optimum grazing schedules and sequences to obtain a high rate of performance; (6) develop more effective and economical control of weeds and poisonous plants; (7) obtain data to which the economic yardstick may be applied under the variable cost-price structures that generally occur in the livestock industry.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Development and Testing of a Simulation Model to Highlight Critical Livestock-Forage Management Research Needs

FY 1981 Increase SY 4 Amount **$520,000**

Suggested Locations: Lexington, Ky.; College Station, Tex.; Clemson, S.C.; Stillwater, Okla.; Fayetteville, Ark.

Need for Increase: Systems research is needed to delineate and solve the problems associated with different livestock-forage production systems and to determine income producing capabilities of the different systems. Systems research is needed to determine the performance of livestock-forage production systems when they interact with various resource and management constraints. Computer technology can now allow for the development of a simulation model of the complicated interrelations of the many variables within a system. A simulation research model, properly validated by data from specific research projects, can be used as an artificial laboratory to study livestock-forage production systems. The information generated by such a model will point up the "gaps" in research data that are needed to be part of any management decision concerning the livestock-forage production systems.

Plan of Work: The research will involve the design of experiments at a number of locations in the Southern Region in order to obtain the desired data on response of forages to environment, the responses of the different cattle to the forages, and the effect of the various aspects of management, such as animal health practices, supplemental feed, feed additives, stocking rates, etc., on the production of forage-fed beef. The data from these many, well-designed and replicated studies will be fed into a single computer that contains a multifaceted, highly complex simulation model for the many interrelations of the livestock-forage system. Once this model has been completed it will be necessary to validate all of the parameters by specific experimentation upon specific interactions at specific locations. This research will be done in concert with the computer modeling teams at Kentucky and Texas.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Development of Innovative Methods to Enhance Livestock-Forage Management Research

Suggested Locations: Florida, Texas, Oklahoma, North Carolina, Virginia, Georgia, Kentucky, Alabama, Mississippi, Tennessee, Louisiana

FY 1981 Increase SY **3** Amount **$500,000**

Need for Increase: In the Southern Region, forage serves as the major feed (over 90 %) used in cattle enterprises. This includes primarily cow-calf operations with some wintering of yearlings and fattening on forage-supplemented diets. The beef industry in the Region would be greatly benefited if the nature of forage grasses, especially warm-season perennials, could be altered to permit a higher daily intake of energy, and if forage characteristics (including quality, quantity and seasonal distribution) could be matched to animal requirement such that efficient forage utilization occurs concurrently with desired animal responses. The need for the development of sound methods that can be used to obtain plant measurements that will reasonably reflect animal responses and methods to measure animal acceptance, dry matter intake and rate of passage of grazing animals has long been recognized, but not well understood and inadequately researched.

Plan of work: Methodology research on selected problems would be highlighted by key locations. (1) Infared reflectance spectroscopy of forages differing in quality and composition would proceed at Athens, Ga., and would be initiated at Gainesville, Fla., El Reno, Okla., Lexington, Ky., and Mississippi State, Miss. (2) Methods to predict voluntary intake by grazing animals would be emphasized at El Reno, Okla.; Raleigh, N.C.; Gainesville, Fla.; Overton, Tex.; and, Auburn, Ala. (3) The efficiency and environmental needs of nitrogen-fixing nicroflora would be studied at Mississippi State, Miss. and Angleton, Tex. (4) The quality and composition of live animals would be studied at Knoxville, Tenn.; Gainesville, Fla.; College Station, Tex.; and Baton Rouge, La. (5) Feeder calf grading standards would be refined at Knoxville, Tenn., and Blacksburg, Va.

Research Increase Proposal, Fiscal Year 1981

Southern Region July 10, 1978

Proposal: Assess the Role of Livestock-Forage Production as a Multiple Land Use Alternative on the Marginal and Disturbed Lands of the South

FY 1981 Increase SY **7** Amount **$910,000**

Suggested Locations: Gainesville, Fla.; Blacksburg, Va.; Lexington, Ky.; Morrilton, Ark.; Auburn, Ala.; Woodward, Okla.; Raleigh, N.C.; College Station, Tex.; Watkinsville, Ga.; Angleton, Tex.; El Reno, Okla.; Fayetteville, Ark.; Rosepine, La.; Clemson, S.C.

Need for Increase: It has been estimated that red meat production from the marginal and disturbed lands and forested ranges of the South could be tripled if methods to more effectively manage these resources were developed. Increased red meat production must be achieved, however, in an economic and sociologic atmosphere where alternative land uses can and oftentimes should predominate. Tremendous potential exists for multiple-use production systems involving combinations of timber, pulpwood, water harvest, wildlife, recreation and livestock. The compatability, production efficiency, and economics of other enterprises in combination with livestock production, are generally unknown.

Plan of Work: Research will be coordinated among a multidisciplined group of scientists representing selected State Experiment Stations; the SEA-FR; the Forest Service and interested private and public research foundations. Soil, plant, animal and systems scientists would develop integrated schemes for production of livestock from the (1) reclaimed stripmined lands in the Ozarks and southern Appalachians (coal) and pit-mined lands of North Carolina and Florida (phosphate), (2) disturbed and eroded prairies of the southern Great Plains, (3) Upland hardwood forested woodlands, (4) Mississippi delta, and (5) Gulf Coast. This research would augment and support modest expansion of ongoing simulation and optimization modeling activities at College Station, Tex.; Lexington, Ky.; Morrilton, Ark.; and Auburn, Ala. Soils and forage research positions would be established in Gainesville, Fla.; Blacksburg, Va.; Woodward, Okla.; Angleton, Tex. and Watkinsville, Ga. Animal Science research positions would be established in Blacksburg, Va.; Fayetteville, Ark.; El Reno, Okla. and Rosepine, La.

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